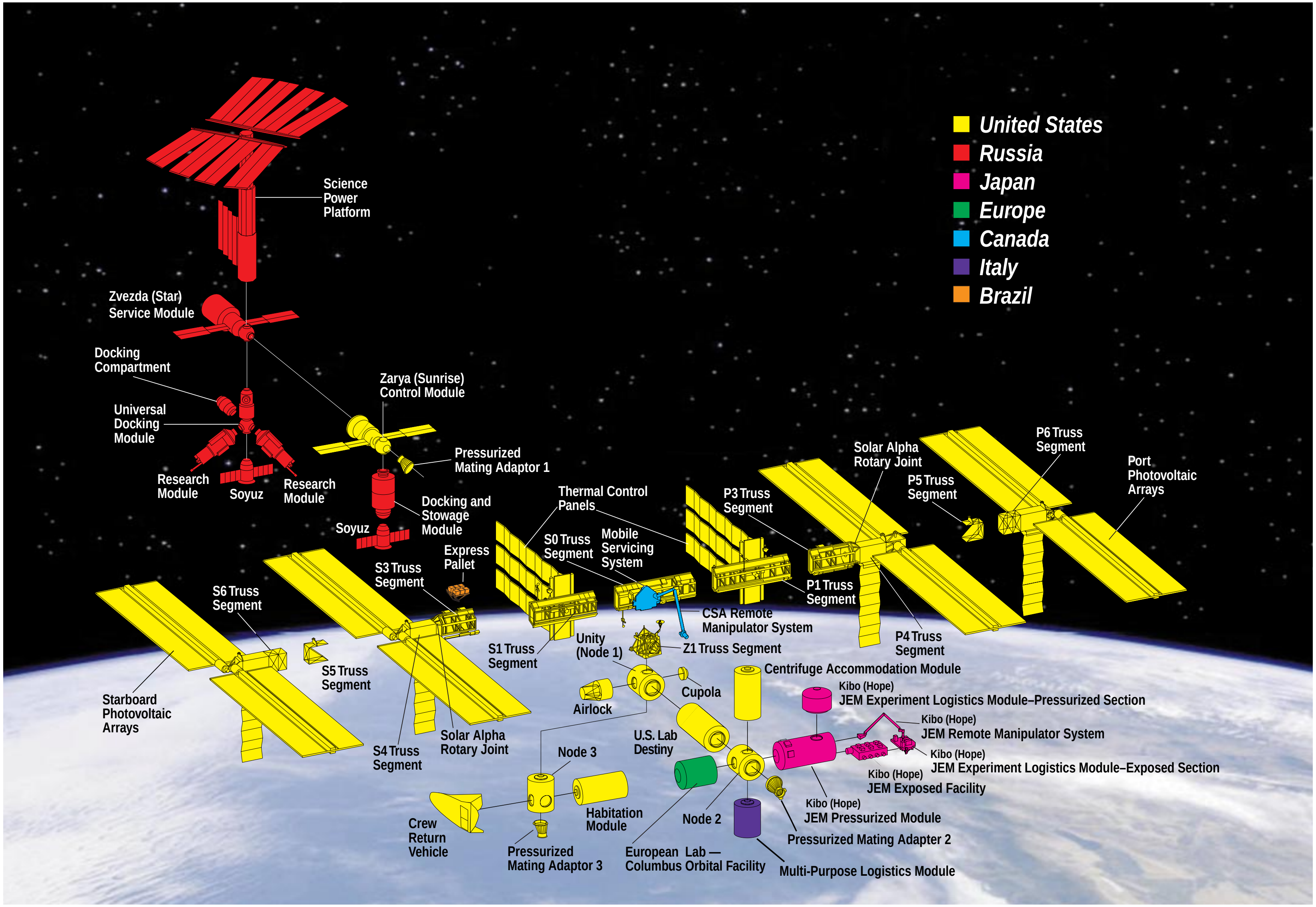
National Aeronautics and
Space Administration

International Space Station Assembly



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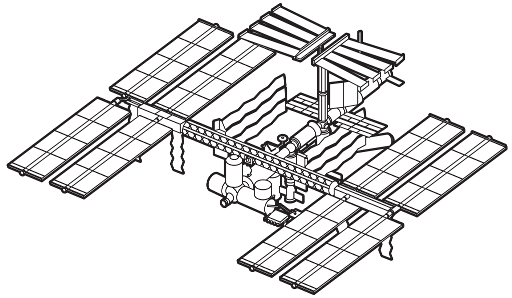
The International Space Station (ISS) is an unparalleled international scientific and technological cooperative venture that will usher in a new era of human space exploration and research and provide benefits to people on Earth. The ISS is a million-pound engineering marvel—designing, building, testing, outfitting, launching, assembling, and operating it are tremendous challenges.

On-orbit assembly began on November 20, 1998, with the launch of the first ISS component, Zarya (Sunrise) on a Russian Proton rocket from the Baikonur Cosmodrome in Kazakhstan. The Space Shuttle followed on December 4, 1998, carrying the U.S.-built Unity connecting module.

The ISS will enable nations to work together to perform scientific and technological investigations and encourage the commercial use of space. Sixteen nations are participating in the ISS program: the United States, Canada, Japan, Russia, Brazil, Belgium, Denmark, France, Germany, Italy, the Netherlands, Norway, Spain, Sweden, Switzerland, and the United Kingdom. NASA and its prime contractor, the Boeing Company, manage the U.S. program.

ISS assembly is leading to new ways of working in space and new technologies that will help future space exploration and be useful on Earth. Over five years, a total of more than 40 space flights by at least three different vehicles—the Space Shuttle, the Russian Proton rocket, and the Russian Soyuz rocket—will bring together more than 100 different Station components and the ISS crew. Astronauts will perform many spacewalks and use new robotics and other technologies to assemble ISS components in space.

The United States and Russia have worked together in space since 1994 as a precursor to the construction of the ISS in orbit. The two nations accomplished nine dockings of the U.S. Shuttle to the Russian Mir Space Station, including seven long-duration missions for U.S. astronauts aboard Mir. The United States and Russia gained valuable experience and built an effective team that is providing valuable insight and capability in the assembly, operations, and maintenance of the ISS. While on Mir, astronauts conducted scientific research that will be expanded on the ISS. The ninth and last Shuttle-Mir docking mission occurred in June 1998.



The initial on-orbit component Zarya (Sunrise) Control Module provides attitude control and propulsion during the early assembly operations, plus solar power and berthing ports for additional modules. In late 1999, Russia will launch the Zvezda (Star) Service Module, the first wholly Russian contribution, from Baikonur. The Zvezda (Star) Service Module will provide initial living quarters and life support systems for the first expeditions (three-person teams) to live and work on the ISS. In the Spring of 2000, the launch of Expedition 1 aboard a Russian Soyuz capsule will begin permanent habitation of the ISS. Crews will spend about three months on board the ISS.

The U.S. laboratory named "Destiny" will be delivered to the station a few months after the launch of Expedition 1, enabling the beginning of greatly enhanced U.S. scientific research. Then the Canadian Space Station Remote Manipulator System, a 58-foot (17.6-meter) robotic arm, will arrive to facilitate assembly and maintenance. The addition of an airlock in 2000 will enable astronauts to conduct spacewalks between Shuttle flights.

Further assembly will see the ISS completed as a premier research facility in space. Three Italian Multi-Purpose Logistics Modules, or pressurized containers, will be used to transport food, equipment, and experiments, via the Space Shuttle, to and from the Space Station. Brazil is providing equipment to carry materials to and from the ISS—the Unpressurized Logistics Carrier will ferry cargo not requiring pressurization, and the Express Pallet will carry experiments to be placed outside the ISS. The Canadian robotic arm will be enhanced by the delivery of a two-armed robot that acts like a "hand" to perform delicate maintenance and assembly tasks usually conducted by astronauts. Also, a European robotic arm will be delivered to the ISS to maintain the Russian segments.

The ISS will include six laboratories and be four times larger and more capable than any previous space station. The United States will provide two laboratories (United States Laboratory and Centrifuge Accommodation Module) and a habitation module for four crew members. There will be two Russian research modules; one Japanese laboratory referred to as the Japanese Experiment Module (JEM) named "Kibo" (Hope); and one European Space Agency (ESA) laboratory called the Columbus Orbital Facility (COF). The station's internal volume will be roughly equivalent to the passenger cabin volume of two 747 jets.

The ISS will provide more space for research than any spacecraft ever built. The U.S., ESA, and Japanese laboratories together will provide 37 International Standard Payload Racks (ISPR). An ISPR, about the size of a home refrigerator, holds research equipment and experiments. Additional research space will be available in connecting nodes and the Russian modules.

The JEM also has an exterior "back porch" with 10 spaces for mounting experiments that need to be exposed to space. The experiments will be set outside using a small robotic arm on the JEM. There are also four attached payload sites on the truss and two spaces on the COF for mounting external experiments. The Brazilian Express Pallet will accommodate experiments to be located on the truss. Brazil will also provide a laboratory window mount that will hold Earth-studying experiments.

The central girder connecting the modules and the main solar power arrays will be built by the United States and is called the Integrated Truss Structure. The Canadian Space Station Remote Manipulator System will move along the truss on a mobile base transporter. The four solar arrays will rotate on the truss to maximize their exposure to the Sun.

When it is completed, the ISS will house an international crew of up to seven for stays of approximately three months. Emergency crew return vehicles will always be docked with the ISS while it is inhabited, to assure the return of all crew members. Initially, a Russian Soyuz spacecraft, which has a crew capacity of three, will be used. Later, a higher capacity, U.S.-built vehicle called the Crew Return Vehicle (CRV) now under development based on a prototype called the X-38, will allow up to seven people to return to Earth.